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THE QUATERNARY DEPOSITS AT VERO, FLORIDA, AND THE VERTEBRATE REMAINS CONTAINED THEREIN

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I arrived at Vero on the evening of October 25 and left there on October 31. Having examined with some care the geological situation and having studied somewhat the vertebrate fossils found in the strata designated by Dr. Sellards as No. 2 and No. 3, I reach the following conclusions:

1. *Stratum No. 2 was in general laid down during the Pleistocene.*—It seems hardly necessary to present arguments to sustain this conclusion, for it is hardly probable that anyone will call it in question. It is possible that some parts of the stratum were afterward re-worked by the streamlet which flowed over it, but this was accomplished during Pleistocene times.

2. *The vertebrate fauna of No. 2 belongs to the Pleistocene, and most of it is there by primary inclusion.*—No place was discovered from which the included bones and teeth might have been washed in, nor do they in general have the appearance of transported fossils. These bony remains are in what may be regarded as a normal condition; as when, in a little valley furnishing food and drink and shade, herbivorous and carnivorous species had resorted and perished there for thousands of years. In a normal way their bones have almost all fallen into dust. Some, buried under somewhat favorable conditions, endured longer, but softened and were trampled into fragments by succeeding generations of elephants, mastodons, horses, bisons, huge ground sloths, and smaller forms. Only the most favored and protected bones and teeth have endured to the present, mostly scattered, but sometimes remaining associated with others of the same skeleton.

3. *At least the lower part of No. 3 is also of Pleistocene age.*—This deposit is somewhat more difficult to work for fossils, but it

has furnished almost all the forms that are found in No. 2. It is not improbable that some bones and teeth were redeposited from the lower stratum, but not, I think, any considerable or essential portion of them.

a) Considering the relatively small amount of erosion which No. 2 suffered from the stream which laid down the muck bed, there are too many fossils in the latter to permit the conclusion that any great number of them came from the older deposit. The lowest layers of muck early formed a blanket which protected the sands of No. 2 from further disturbance.

b) The state of preservation of the fossils of No. 3 does not indicate that they were redeposited from No. 2. They are not more broken and waterworn than those of No. 2.

c) There are some extinct species in No. 3 whose remains must lie where originally buried. The box-tortoise *Terrapene innoxia* is found in both strata. Although the bones of the carapace are usually co-ossified into one mass, this shell is so thin and brittle that it would certainly have fallen into pieces on being rolled along a stream bed. It is even now extremely difficult to unearth a shell without breaking it. Yet one whole carapace and large portions of others have been secured from No. 3. From this muck bed there come seven bones of one individual of an extinct snapping tortoise, probably *Chelydra sculpta*. The shell of this animal, like that of our living species, is thin and loosely articulated. On maceration the bones separate easily. Had the seven bones referred to been buried originally in No. 2, they would, on being washed out, have been scattered like autumn leaves.

d) In No. 3 there is a deer of the genus *Odocoileus* which is smaller than the one found in No. 2.¹ From No. 3 Dr. Sellards has sent me a fifth cervical vertebra which shows that this deer is very distinct from the existing Virginia deer and still farther removed from the mule deer. The fox referred with doubt by Dr. Sellards to the red fox is certainly an undescribed species, having had a heavier lower jaw than that of the red fox. A femur from No. 3 probably belongs to the same species. It is larger, straighter, and more flattened than that of the red fox.

¹ Sellards, 8th Ann. Rep. Fla. Geol. Surv. p. 149.

In short, there are so many well-preserved extinct vertebrates in No. 3 that it must be referred to the Pleistocene; and the study of the collections adds continually to the number.

4. *A few words only about the human bones.*—I consider now only those found at the locality illustrated by Sellards' Text-Fig. 6 and his Plate 16 and Plate 17, Fig. 2. Had no human bones been found there the following explanation would, I think, hardly be questioned. No. 2, consisting mostly of sand, had been deposited, leaving traces of horizontal stratification. At a later time the swollen streamlet cut down through it to the underlying marl. About four feet away at the same time it cut down nearly to the marl. The two currents left a ridge of undisturbed sand which contained some bones. As the currents lost their force, sand began to be deposited on the sides and summit of the ridge. Had there been any considerable interval, this ridge of sand would have been flattened down and disturbed in various ways. Before the freshet spent itself a mass of vegetation was swept down and deposited, mostly in the channels but partly on the ridge, thus sealing it in until our day. As to the human bones found lying on the slope of No. 2, a reasonable explanation is that they had previously been scattered and inclosed in its sands and then laid bare by the freshet. Their condition of fossilization is the same as that of the animal bones found near by, and their broken condition indicates that they had suffered from the trampling of animals, as those other bones had.

5. *The age of stratum No. 2 and of at least the lower part of No. 3 is not later than middle Pleistocene.*—The fauna afforded by the deposits in question is essentially that which is found in the Aftonian interglacial beds in Iowa and in the *Equus* beds of the Plains. From the latter it may be followed into Texas, thence eastward into Florida and South Carolina. Of this fauna two species of elephants, the common mastodon, *Megalonyx*, and the giant beaver, continued on until after the Wisconsin glacial stage. Other species, the saber-tooth tigers, *Equus complicatus*, the tapirs, most of the extinct bisons, and *Mylodon* probably disappeared before the Wisconsin. In the earlier Pleistocene deposits only are found *Elephas imperator*, camels, several species of horses, and many edentates. At Vero have been found three species of horses, at least four

edentates (including *Mylodon*), and a camel. *Chlamytherium* was originally found on Peace Creek in deposits which were then supposed to be Pliocene. In the same deposits was found a jaw containing a tooth of an elephant which is quite likely *E. imperator*. This species has not yet been found in No. 2 at Vero, but about three miles west of the place Sellards found a lower jaw which belongs probably to this species. It is known from Dallas County, Alabama, and from Charleston, South Carolina. The writer regards it and camel remains as particularly indicative of the Aftonian fauna.

It is possible that this fauna continued on for another stage or two without great change, but by the time of the Illinoian drift it had become essentially modified.

6. *The human bones appear to be of Pleistocene age.*—At present I perceive no other reason for doubting this than that their presence in No. 2 and No. 3 contravenes our present ideas regarding the history of the human race.